FORM PTO-1390
REV. 5-93

US DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEYS DOCKET NUMBER
P01,0315

U.S.APPLICATION NO. (if known, see 37 CFR 1.5)
10/030010

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE00/01133	**12 April 2000**	**03 May 1999**

TITLE OF INVENTION
METHOD FOR THE OPERATION OF AN ENGRAVING MACHINE

APPLICANT(S) FOR DO/EO/US
Bernd LÜBCKE

Applicant herewith submits to the United States /Designated/Elected Office (DO/EO/US) the following items and other information:

1. ■ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. □ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ■ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay.
4. ■ A proper Demand for International Preliminary Examination will be made by the 19th month from the earliest claimed priority date.
5. ■ A copy of International Application as filed (35 U.S.C. 371(c)(2))
   a. ■ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. □ has been transmitted by the International Bureau.
   c. □ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ■ A translation of the International Application into English (35 U.S.C. 371(c)(2).
7. ■ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3))
   a. □ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. □ have been transmitted by the International Bureau.
   c. □ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ■ have not been made and will not be made.
8. □ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ■ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). **Executed**
10. □ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ■ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; **(PTO 1449, Prior Art, Search Report).**
12. ■ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
    (SEE ATTACHED ENVELOPE)
13. ■ A FIRST preliminary amendment.
    □ A SECOND or SUBSEQUENT preliminary amendment.
14. ■ A substitute specification **- Marked up copy of Substitute Specification.**
15. □ A change of power of attorney and/or address letter.
16. ■ Other items or information:
    a. ■ Submission of Drawings **- Two sheets of drawings - Drawing Correction Letter**
    b. ■ **EXPRESS MAIL #EL843742744 US dated October 29, 2001**

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5) 10/030011	INTERNATIONAL APPLICATION NO. PCT/DE00/01133	ATTORNEY'S DOCKET NUMBER P01,0315

BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): 531 RECD PCT/PTO 29 OCT 2001

Search Report has been prepared by the EPO or JPO $890.00

International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) $710.00

No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but international search fee paid to USPTO (37 C.F.R. 1.445(a)(2) $740.00

Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2) paid to USPTO $1040.00

International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $ 100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =				$890.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).				$ 0	
Claims	Number Filed		Number Extra	Rate	
Total Claims	24	- 20 =	4	X $ 18.00	$ 72.00
Independent Claims	5	- 3 =	2	X $ 84.00	$ 168.00
Multiple Dependent Claims				$280.00 +	$
TOTAL OF ABOVE CALCULATIONS =					$ 0
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)					$
SUBTOTAL =					$ 1130.00
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$
TOTAL NATIONAL FEE =					$ 1130.00
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). $40.00 per property +					
TOTAL FEES ENCLOSED =					$1130.00
				Amount to be refunded	$
				charged	$

a. ■ A check in the amount of $ **1130.00** to cover the above fees is enclosed.

b. □ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ■ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **501519**. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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BOX PCT

IN THE UNITED STATES ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANT: Bernd Lübcke

DOCKET NO: P01,0315

SERIAL NO: GROUP ART UNIT:

EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE00/01133

INTERNATIONAL FILING DATE: 12 April 2000

INVENTION: **"METHOD FOR THE OPERATION OF AN ENGRAVING MACHINE"**

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

As a Preliminary Amendment for entry into the National Stage for the above-identified PCT application, the following is submitted:

IN THE TITLE, SPECIFICATION AND ABSTRACT:

Please find enclosed a Substitute Specification amending the title, the specification, and the Abstract together with a marked-up copy of the substitute specification and abstract. No new matter is entered in the substitute specification.

IN THE DRAWINGS:

Please amend the drawings as indicated in the attached Drawing Correction Letter.

IN THE CLAIMS:

Please cancel claims 1-19 without prejudice.

Please substitute claims 20-43 as follows:

20. A method for operating an electronic engraving machine for engraving a printing cylinder for rotogravure, comprising the steps of:

before actual engraving of the printing cylinder with an engraving stylus of an engraving element driven by an engraving control signal, engraving sample cups for predetermined rated tonal values in a test engraving with the engraving stylus;

measuring actual dimensions of the sample cups with a measurement device put in place on the printing cylinder and comparing the actual dimensions to rated dimensions corresponding to the predetermined rated tonal values in order to acquire setting values with which the engraving control signal is calibrated such that engraved actual tonal values correspond to the rated tonal values to be engraved;

carrying out a monitoring to see whether or not the measurement device is present on the printing cylinder;

preventing an engraving start when the measurement device is present on the printing cylinder; and

if the measurement device is not present on the printing cylinder, engraving with the engraving stylus a sequence of cups into the rotating printing cylinder

where actual dimensions of the cups determine the actual tonal values that are engraved.

21. The method for operating an engraving machine according to claim 20 wherein a rotation of the printing cylinder is prevented given the presence of the measurement device on the printing cylinder.

22. The method for operating an engraving machine according to claim 20 wherein presence of the measurement device is monitored with a light beam.

23. The method for operating an engraving machine according to claim 20 wherein a control signal is generated given the presence of the measurement device on the printing cylinder.

24. The method for operating an engraving machine according to claim 20 wherein the actual dimensions of the engraved sample cups measured with the measurement device are wirelessly transmitted from the measurement device to a stationary measured value receiver as measured value signals.

25. The method for operating an engraving machine according to claim 24 wherein the stationary measured value receiver is located at the engraving machine.

26. The method for operating an engraving machine according to claim 24 wherein the wireless transmission of the measured values signals only occurs during the calibration.

27. The method for operating an engraving machine according to claim 23 wherein the wireless transmission of the measured value signals is enabled by the control signal.

28. The method for operating an engraving machine according to claim 23 wherein

a plurality of engraving machines are present;

the measurement device is respectively put in place on the printing cylinder of the engraving machine with which the test engraving was implemented; and

the wireless transmission of the measured value signals is respectively selectively enabled by the control signal of the corresponding engraving machine.

29. An engraving machine for engraving printing cylinders for rotogravure with an engraving element, comprising:

a rotationally seated printing cylinder driven by a first drive;

an engraving element driven by an engraving control signal for engraving cups in the printing cylinder that is moved axially past the printing cylinder by a second drive;

a signal editing unit for generating the engraving control signal for the engraving element;

a controller for controlling the engraving machine and which is in communication with the signal editing unit, with the first drive, and with the second drive; and

comprising a monitoring device connected to the controller that checks a presence of a measurement device put in place on the printing cylinder for measuring actual dimensions of engraved sample cups and which prevents a start of engraving.

30. The engraving machine according to claim 29 wherein the monitoring device comprises:

a stationary optoelectronic sensor for generating a monitoring beam proceeding in an axial direction of the printing cylinder and for converting a reflected monitoring beam into an electrical control signal that signals the presence of the measurement device on the printing cylinder; and

a reflector for the monitoring beam that is attached to the measurement device and faces toward the stationary sensor.

31. The engraving machine according to claim 30 wherein the optoelectronic sensor is attached to the engraving machine

32. The engraving machine according to claim 30 wherein the monitoring beam is designed with a lobe in an axial direction of the printing cylinder.

33. The engraving machine according to claim 29 wherein

the measurement device comprises a built-in measured value transmitter for wireless transmission of the measured actual dimensions of the test cups; and

a corresponding measured value receiver that is connected to the signal editing unit and which is attached to the engraving machine.

34. The engraving machine according to claim 33 wherein the monitoring device is in an interactive connection with the measured value receiver.

35. A measurement device for an engraving machine for engraving a printing cylinder with an engraving element, comprising:

a built-in measured value transmitter for wireless transmission of measured actual dimensions of engraved test cups to a stationary measured value receiver.

36. The measurement device according to claim 35 wherein the measurement device is battery operated.

37. The measurement device according to claim 35 wherein the measurement device is a measuring microscope.

38. The measurement device according to claim 35 wherein the measurement device is a video camera.

39. The measurement device of claim 35 wherein a light element is provided on the measurement device designed for determining whether the measurement device is present on the engraving printing cylinder.

40. The device of claim 39 wherein the light element comprises a reflector.

41. The device of claim 35 wherein the measurement device has a component for interacting with a light beam used for determining whether the measurement device is put in place on the printing cylinder in order to prevent a start of engraving if the measurement device is in place on the printing cylinder.

42. A method for operating an electronic engraving machine for engraving a printing cylinder for rotogravure, comprising the steps of:

before actual engraving of the printing cylinder with an engraving stylus of an engraving element driven by an engraving control signal, engraving sample cups for predetermined rated tonal values in a test engraving with the engraving stylus;

measuring actual dimensions of the sample cups with a measurement device adjacent the printing cylinder and comparing the actual dimensions to rated dimensions corresponding to the predetermined rated tonal values in

order to acquire setting values with which the engraving control signal is calibrated such that engraved actual tonal values correspond to the rated tonal values to be engraved;

carrying out a monitoring to see whether or not the measurement device is present on the printing cylinder; and

preventing an engraving start when the measurement device is present on the printing cylinder.

43. A measurement device for an engraving machine for engraving printing cylinders with an engraving element, comprising:

a built-in measured value transmitter for wireless transmission of measured actual dimensions of engraved test cups to a stationary measured value receiver; and

a component which is part of the measurement device for interacting with a light beam in order for determining whether or not the measurement device is put in place on the printing cylinder so that engraving of either test cups or of actual cups will not commence until the measurement device is removed from the printing cylinder.

REMARKS

The specification, title, and abstract have been amended in accordance with U. S. practice. Also new claims are presented drawn in accordance with U. S. practice.

An Information Disclosure Statement is enclosed herewith.

Respectfully submitted,

(Reg. No. 27,841)

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SPECIFICATION

TITLE

"METHOD AND APPARATUS FOR THE OPERATION OF AN ENGRAVING MACHINE"

BACKGROUND OF THE INVENTION

The invention is in the field of electronic reproduction technology and is directed to a method for the operation of an electronic engraving machine for engraving printing cylinders for rotogravure, to an electronic engraving machine as well as to a measuring device for an engraving machine.

In an electronic engraving machine, an engraving element with an engraving stylus as a cutting tool moves along a rotating printing cylinder in the axial direction. The engraving stylus, which is controlled by an engraving control signal, cuts a series of cups arranged in an engraving raster into the generated surface of the printing cylinder. The engraving control signal is formed by superimposition of image signal values, which represent tonal values between "light" and "dark" to be engraved, with a periodic raster signal. Whereas the raster signal effects a vibrating lifting motion of the engraving stylus for generating the engraving raster, the image signal values determine the geometrical dimensions of the cups engraved into the generated surface of the printing cylinder.

Before the actual engraving, sample cups are engraved on the printing cylinder for prescribed tonal values in what is referred to as a test engraving. After the test cut, the actual geometrical dimensions of the engraved sample cups are measured, for example with a measurement microscope placed onto the printing cylinder, and compared to prescribed, rated geometrical dimensions of the cups. Setting values are acquired from the value comparison, the engraving control signal being then calibrated with the setting values such that the cups actually engraved in the later engraving correspond to the cups required for a tonally correct reproduction.

US-A-5,293,426 already discloses a method and an apparatus for operating an electronic engraving machine as well as a measurement device in the form of a measuring microscope for determining the dimensions of engraved cups.

US-A-3,931,570 discloses a portable measurement device for measuring the volumes of engraved cups.

When the operator must operate a plurality of engraving machines simultaneously, particularly in magazine printing, it can occasionally occur in practice that the operator forgets to remove a measurement microscope placed on the printing cylinder for measuring the sample cups from the printing cylinder before the engraving actually starts, as a result whereof the relatively expensive measurement microscope and, potentially, the engraving machine itself can be damaged.

SUMMARY OF THE INVENTION

An object of the present invention is to improve a method for the operation of an engraving machine, an engraving machine as well as a measurement device for an engraving machine such that a reliable engraving is assured, especially given simultaneous operation of a plurality of engraving machines.

According to the invention, a method is provided for operating an electronic engraving machine for engraving printing cylinders for rotogravure. Sample cups are engraved for predetermined rated tonal values and a test engraving with an engraving stylus of an engraving element driven by an engraving control signal before actual engraving of the printing cylinder with the engraving stylus. Actual dimensions of the sample cups are measured with a measurement device put in place on the printing cylinder. The actual dimensions are compared to rated dimensions corresponding to the predetermined rated tonal values in order to acquire setting values with which the engraving control signal is calibrated such that engraved actual tonal values correspond to the rated tonal values to be engraved. A monitoring is carried out to see whether or not the measurement device is present on the printing cylinder. An engraving start is prevented when the measurement device is present on the printing cylinder. With the engraving stylus of the engraving element driven by the engraving control signal, engraving a sequence of cups into the rotating printing cylinder, actual dimensions of the cups determining the actual tonal values that are engraved.

Also in accordance with the invention, an engraving machine is provided for engraving printing cylinders for rotogravure with an engraving element. A rotationally seated printing cylinder is driven by a first drive. An engraving element is driven by an engraving control signal for engraving cups in the printing cylinder that can be moved axially passed the printing cylinder by a second drive. A signal and editing unit generates the engraved control signal for the engraving element. A controller controls the engraving machine, the controller being in communication with the signal editing unit, with the first drive, and with the second drive. The engraving machine comprises a monitoring device connected to the control that checks a presence of a measurement device put in place on the printing cylinder for measuring actual dimensions of engraved sample cups and which prevents a start of engraving. Also according to the invention, a measurement device is provided for an engraving machine for engraving printing cylinders with an engraving element comprising a built-in measured value transmitter for wireless transmission of measured actual dimensions of engraved test cups to a stationary measured value receiver. Also according to the invention, a light element is provided on the measurement device designed for determining whether the measurement device is present on the engraving printing cylinder.

The invention is explained in greater detail below on the basis of Figures 1 and 2.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows the fundamental mechanical structure of an engraving machine in a side view; and

Figure 2 is a block circuit diagram of an engraving machine.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a side view of the fundamental mechanical structure of an electronic engraving machine for engraving printing cylinders for rotogravure. The engraving machine, for example, is a HelioKlischograph® of Hell Gravure Systems GmbH, Kiel, DE.

A printing cylinder 1 has its shaft ends 2, 3 rotationally seated in two pillow blocks 4, 5 that are mounted on a machine bed 6. Via a coupling 7, the printing cylinder 1 is driven by a cylinder drive 8 that is accommodated in a lateral drive tower 9 of the engraving machine. The engraving on the printing cylinder 1 occurs with an engraving stylus of an engraving element (not shown) that is driven by an engraving control signal and moves axially along the rotating printing cylinder 1 for planar engraving.

Before the actual engraving of the printing cylinder 1, sample cups 10 are engraved on the printing cylinder 1 in the test engraving, the actual geometrical dimensions of the sample cups 10 being measured with an optical or electronic measurement device 11 put in place on the printing cylinder 1 and being compared to the prescribed, rated geometrical dimensions of the sample cups 10. Setting values are acquired from the value comparison, the engraving control signal being then calibrated with the setting values such the cups actually engraved in the later engraving correspond to the cups required for a tonally correct reproduction. The measurement device 11, for example, is a measurement microscope with an integrated scale or a video camera. In the case of a video camera, the measurement of the actual dimensions of the engraved sample cups occurs electronically in the video image registered by the video camera, for example according to WO-A-98/55302.

When the operator, in particular, must operate a plurality of engraving machines simultaneously, it can occasionally occur in practice that the operator forgets to remove the measurement device 11 from the printing cylinder 1 before starting the engraving, and damage to the relatively expensive measurement device and/or to the engraving machine would be the consequence.

In order to avoid such damage with the invention, automatic supervision is carried out as to whether a measurement device 11 is located on the printing cylinder 1 or not and, when this is the case, an engraving start is prevented and/or displayed.

For this purpose, the engraving machine comprises a monitoring device 12, 13, 14 that, given the illustrated exemplary embodiment, comprises a stationary

optoelectronic sensor 12 attached to the drive tower 9 of the engraving machine and a reflector 13 that is located at the measurement device 11 and faces toward the sensor 12. The sensor 12 generates a monitoring beam 14 proceeding in the axial direction of the printing cylinder 1 such that the reflector 13 of the measurement device 11 reflects onto the stationary sensor 12 when the measurement instrument 11 is situated on the printing cylinder 1. The sensor 12 then generates a corresponding electrical control signal KS on a line 15 for further processing.

The sensor 12 is attached to the drive tower 9 at such a height that the reflector 13 approximately lies on the optical axis of the sensor 12 when the measurement device 11 is on a printing cylinder 1 having an average diameter. Expediently, the monitoring beam 14 has a lobe shape in the propagation direction with a relatively large cross-section in the region of the reflector 13. What is thereby achieved is that the monitoring beam 14 is also acquired by the reflector 13 when the latter is offset to different heights due to different diameters of the respective printing cylinder 1 or in a circumferential direction of the printing cylinder 1 due to an imprecise positioning of the measurement device 11 relative to the optical axis of the sensor 12. As a result of the lobe shape of the monitoring beam 14, the reflection is also independent of the axial measuring position of the measurement device 11 on the printing cylinder 1. Further, it proves expedient to attach a corresponding reflector 13 to each end face of the measurement device 11. The invention is not limited to the described exemplary embodiment for the monitoring device. For example, the monitoring of the measurement device can also occur with a light barrier. In this case, the reflector is stationarily secured to the engraving machine, or a light source for generating the monitoring beam is arranged at that side lying opposite the sensor.

It also proves advantageous to wirelessly transmit the measured values acquired with the mobile measurement device 11 to a stationary measured value receiver with a measured value transmitter 16 integrated into the measurement device 11. In the illustrated exemplary embodiment, the stationary measured value receiver 17 is likewise attached to the drive tower 9 of the engraving machine. The measured

values wirelessly communicated to the measured value receiver 17 are converted thereat into electrical measured value signals MS on a line 18 for further-processing. The transmission of the measured values can occur with light, for example IR light, sound or electromagnetically RF.

For assuring dependable operation, it proves advantageous to only enable the transmission of measured values to an engraving machine when a measurement device 11 is also located on the printing cylinder 1 of the corresponding engraving machine and the measured values are also in fact needed for calibration. In order to meet this demand, the enablement of the measured value transmission is inventively controlled by the control signal KS.

The measurement device 11, which is configured for a wireless measured value transmission and -- over and above this -- is battery operated, can be advantageously utilized for a plurality of engraving machine, whereby each engraving machine is equipped with a monitoring device 12, 13, 14 and a measured value receiver 17, and the mobile measurement device 11 is transported from engraving machine to engraving machine as needed.

In this case, too, it proves expedient to control the measured value transmission to an engraving machine with the control signal KS of this engraving machine such that the measured value transmission occurs only in the calibration phase and, selectively, only for the corresponding engraving machine.

Figure 2 shows a block circuit diagram of an engraving machine. The printing cylinder 1 is rotationally driven by the cylinder drive 8. The engraving on the printing cylinder 1 occurs with an engraving element 20 that, for example, is designed as an electromagnetic engraving element with an engraving stylus 21 as the cutting tool. The engraving element 20 is located on an engraving carriage 22 that is moved axially past the printing cylinder 1 by an engraving carriage drive 24 by means of a spindle 23.

The engraving stylus 22 of the engraving element 21 is controlled by an engraving control signal GS. The engraving control signal GS is formed in an

engraving amplifier 25 by superimposition of a periodic raster signal R with image signal values B that represent the tonal values between "light" and "dark" of the cups to be engraved. Whereas the periodic raster signal R effects a vibrating lifting motion of the engraving stylus 21 for generating the engraving raster, the image signal values B determine the penetration depth of the engraving stylus 21 into the printing cylinder 1 in conformity with the tonal values to be engraved.

The analog image signal values B are acquired in a D/A converter 26 from engraving data GD that are deposited in an engraving data memory 27, are read out therefrom engraving line by engraving line, and are supplied to the D/A converter 26.

The printing cylinder 1 has an XY-coordinate system allocated to it whose X-axis is oriented in the axial direction of the printing cylinder 1 and whose Y-axis is oriented in the circumferential direction of the printing cylinder 1. The engraving carriage drive 24 generates the x-location coordinates and a position sensor 28 mechanically coupled to the cylinder drive 8 generates the y-location coordinates, these being supplied via lines 29, 30 to a controller 31.

The controller 31 controls the addressing and the readout of the engraving data GD from the engraving data memory 27 dependent on the xy-coordinates of the current engraving locations via a line 32. The controller 31 also generates the raster signal R on a line 33, a control signal S_1 on a line 34 for starting and stopping the cylinder drive 8, and a control signal S_2 on a line 35 for starting and stopping the engraving carriage drive 24.

For the implementation of a test cut before the actual engraving, the engraving machine comprises a test engraving computer 36 that supplies the engraving data GD* required for engraving the sample cups 10 to the D/A converter 26, these representing the predetermined rated tonal value of the sample cup 10. After the test engraving, the measurement device 11 is put in place on the printing cylinder, as described in Figure 1. The geometrical actual dimensions of the engraved samples cups 10 are then measured with the measurement device 11 and transmitted to the measured value receiver 17, the measured actual dimensions being transported from

the latter to the test engraving computer 36 as measured value signal MS via the line 18. By comparing the measured actual dimensions to predetermined rated dimensions, setting values for the calibration of the engraving amplifier 25 that are supplied thereto via a line 37 are acquired in the test engraving computer 36.

The control signal KS generated by the monitoring device 12, 13, 14, whereof only the optoelectronic sensor 12 is shown in Figure 2, proceeds via the line 15 to the controller 31 If one forgot to remove the measurement device 11 (not shown in Figure 2) from the printing cylinder 1 after the calibration phase, the control signal KS in the controller 31 -- via the control signal S_1 -- prevents the rotation of the printing cylinder and, potentially, prevents the feed motion of the engraving carriage 22 via the control signal S_2.

The control signal KS also controls an enable unit 38 with which the transfer of the measured signals MS to the test engraving computer 36 is enabled only in the calibration phase.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

ABSTRACT OF THE DISCLOSURE

In a method for operating an electronic engraving machine for engraving printing cylinders for rotogravure with an engraving stylus of an engraving element driven by an engraving control signal, for calibration of the engraving control signal, sample cups for prescribed rated tonal values are engraved in a test engraving and their actual dimensions are measured with a mobile measurement device but in place on the printing cylinder. In order to avoid a destruction of the measurement device, a monitoring device monitors whether the measurement device is on the printing cylinder or not and prevents an engraving start when the measurement device is present on the printing cylinder. The identified measured values are wirelessly transmitted from the mobile measurement device to a stationary measured value receiver. The monitoring device assures that the wireless transmission of the measured values only occurs during the calibration.

SPECIFICATION

TITLE

"METHOD AND APPARATUS [METHOD] FOR THE OPERATION OF AN ENGRAVING MACHINE"

BACKGROUND OF THE INVENTION

The invention is in the field of electronic reproduction technology and is directed to a method for the operation of an electronic engraving machine for engraving printing cylinders for rotogravure, to an electronic engraving machine as well as to a measuring device for an engraving machine.

In an electronic engraving machine, an engraving element with an engraving stylus as a cutting tool moves along a rotating printing cylinder in the axial direction. The engraving stylus, which is controlled by an engraving control signal, cuts a series of cups arranged in an engraving raster into the generated surface of the printing cylinder. The engraving control signal is formed by superimposition of image signal values, which [represents [sic] to] represent tonal values between "light" and "dark" to be engraved, with a periodic raster signal. Whereas the raster signal effects a vibrating lifting motion of the engraving stylus for generating the engraving raster, the image signal values determine the geometrical dimensions of the cups engraved into the generated surface of the printing cylinder.

Before the actual engraving, sample cups are engraved on the printing cylinder for prescribed tonal values in what is referred to as a test engraving. After the test cut, the actual geometrical dimensions of the engraved sample cups are measured, for example with a measurement microscope placed onto the printing cylinder, and compared to prescribed, rated geometrical dimensions of the cups. Setting values are acquired from the value comparison, the engraving control signal being then calibrated [such] with [said] the setting values such that the cups actually engraved in the later engraving correspond to the cups required for a tonally correct reproduction.

US-A-5,293,426 already discloses a method and an apparatus for operating an electronic engraving machine as well as a measurement device in the form of a measuring microscope for determining the dimensions of engraved cups.

US-A-3,931,570 discloses a portable measurement device for measuring the volumes of engraved cups.

When the operator must operate a plurality of engraving machines simultaneously, particularly in magazine printing, it can occasionally occur in practice that the operator forgets to remove a measurement microscope placed on the printing cylinder for measuring the sample cups from the printing cylinder before the engraving actually starts, as a result whereof the relatively expensive measurement microscope and, potentially, the engraving machine itself can be damaged.

SUMMARY OF THE INVENTION

An object of the present invention is [therefore] to improve a method for the operation of an engraving machine, an engraving machine as well as a measurement device for an engraving machine such that a reliable engraving is assured, especially given simultaneous operation of a plurality of engraving machines.

[This object is achieved by claim 1 with respect to the method, by claim 10 with respect to the engraving machine and by claim 16 with respect to] According to the invention, a method is provided for operating an electronic engraving machine for engraving printing cylinders for rotogravure. Sample cups are engraved for predetermined rated tonal values and a test engraving with an engraving stylus of an engraving element driven by an engraving control signal before actual engraving of the printing cylinder with the engraving stylus. Actual dimensions of the sample cups are measured with a measurement device put in place on the printing cylinder. The actual dimensions are compared to rated dimensions corresponding to the predetermined rated tonal values in order to acquire setting values with which the engraving control signal is calibrated such that engraved actual tonal values correspond to the rated tonal values to be engraved. A monitoring is carried out to see whether or not the measurement device[. Advantageous developments and

improvements are indicated in the subclaims.] is present on the printing cylinder. An engraving start is prevented when the measurement device is present on the printing cylinder. With the engraving stylus of the engraving element driven by the engraving control signal, engraving a sequence of cups into the rotating printing cylinder, actual dimensions of the cups determining the actual tonal values that are engraved.

Also in accordance with the invention, an engraving machine is provided for engraving printing cylinders for rotogravure with an engraving element. A rotationally seated printing cylinder is driven by a first drive. An engraving element is driven by an engraving control signal for engraving cups in the printing cylinder that can be moved axially passed the printing cylinder by a second drive. A signal and editing unit generates the engraved control signal for the engraving element. A controller controls the engraving machine, the controller being in communication with the signal editing unit, with the first drive, and with the second drive. The engraving machine comprises a monitoring device connected to the control that checks a presence of a measurement device put in place on the printing cylinder for measuring actual dimensions of engraved sample cups and which prevents a start of engraving. Also according to the invention, a measurement device is provided for an engraving machine for engraving printing cylinders with an engraving element comprising a built-in measured value transmitter for wireless transmission of measured actual dimensions of engraved test cups to a stationary measured value receiver. Also according to the invention, a light element is provided on the measurement device designed for determining whether the measurement device is present on the engraving printing cylinder.

The invention is explained in greater detail below on the basis of Figures 1 and 2.

[Shown are:] BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows the fundamental mechanical structure of an engraving machine[, shown] in a side view; and

Figure 2 is a block circuit diagram of an engraving machine.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a side view of the fundamental mechanical structure of an electronic engraving machine for engraving printing cylinders for rotogravure. The engraving machine, for example, is a HelioKlischograph® of Hell Gravure Systems GmbH, Kiel, DE.

A printing cylinder [(1)] 1 has its shaft ends [(2, 3)] 2, 3 rotationally seated in two pillow blocks [(4, 5)] 4, 5 that are mounted on a machine bed [(6)] 6. Via a coupling [(7)] 7, the printing cylinder [(1)] 1 is driven by a cylinder drive [(8)] 8 that is accommodated in a lateral drive tower [(9)] 9 of the engraving machine. The engraving on the printing cylinder [(1) ensues] 1 occurs with an engraving stylus of an engraving element (not shown) that is driven by an engraving control signal and moves axially along the rotating printing cylinder [(1)] 1 for planar engraving.

Before the actual engraving of the printing cylinder [(1),] 1, sample cups [(10)] 10 are engraved on the printing cylinder [(1)] 1 in the test engraving, the actual geometrical dimensions of [said] the sample cups [(10)] 10 being measured with an optical or electronic measurement device [(11)] 11 put in place on the printing cylinder [(1)] 1 and being compared to the prescribed, rated geometrical dimensions of the sample cups [(10)] 10. Setting values are acquired from the value comparison, the engraving control signal being then calibrated [such] with [said] the setting values [that] such the cups actually engraved in the later engraving correspond to the cups required for a tonally correct reproduction.

The measurement device [(11)] 11, for example, is a measurement microscope with an integrated scale or a video camera. In the case of a video camera, the measurement of the actual dimensions of the engraved sample cups [ensues] occurs electronically in the video image registered by the video camera, for example according to WO-A-98/55302.

When the operator, in particular, must operate a plurality of engraving machines simultaneously, it can occasionally occur in practice that the operator forgets to remove the measurement device [(11)] 11 from the printing cylinder [(1)] 1

before starting the engraving, and damage to the relatively expensive measurement device and/or to the engraving machine would be the consequence.

In order to avoid such damage with the invention, automatic supervision is [inventively] carried out as to whether a measurement device [(11)] 11 is located on the printing cylinder [(1)] 1 or not and, when this is the case, an engraving start is prevented and/or displayed.

[To] For this [end] purpose, the engraving machine comprises a monitoring device [(]12, 13, 14[)] that, given the illustrated exemplary embodiment, [is composed of] comprises a stationary optoelectronic sensor [(12)] 12 attached to the drive tower [(9)] 9 of the engraving machine and a reflector [(13)] 13 that is located at the measurement device [(11)] 11 and faces toward the sensor [(12).] 12. The sensor [(12)] 12 generates a monitoring beam [(14)] 14 proceeding in the axial direction of the printing cylinder [(1)] 1 such that the reflector [(13)] 13 of the measurement device [(11)] 11 reflects onto the stationary sensor [(12)] 12 when the measurement instrument [(11)] 11 is situated on the printing cylinder [(1).] 1. The sensor [(12)] 12 then generates a corresponding electrical control signal KS on a line [(15)] 15 for further processing.

The sensor [(12)] 12 is attached to the drive tower [(9)] 9 at such a height that the reflector [(13)] 13 approximately lies on the optical axis of the sensor [(12)] 12 when the measurement device [(11)] 11 is on a printing cylinder [(1)] 1 having an average diameter. Expediently, the monitoring beam [(14) fashioned is lobar in]14 has a lobe shape in the propagation direction with a relatively large [crossection] cross-section in the region of the reflector [(13)] 13. What is thereby achieved is that the monitoring beam [(14)] 14 is also acquired by the reflector [(13)] 13 when the latter is offset to different heights due to different diameters of the respective printing cylinder [(1)] 1 or in a circumferential direction of the printing cylinder [(1)] 1 due to an imprecise positioning of the measurement device [(11)] 11 relative to the optical axis of the sensor [(12)] 12. As a result of the lobe shape of the monitoring beam [(14)] 14, the reflection is also independent of the axial measuring position of the

measurement device [(11)] 11 on the printing cylinder [(1)] 1. Further, it proves expedient to [attache] attach a corresponding reflector [(13)] 13 to each end face of the measurement device [(11)] 11. The invention is not limited to the described exemplary embodiment for the monitoring device. For example, the monitoring of the measurement device can also [ensue] occur with a light barrier. In this case, the reflector is stationarily secured to the engraving machine, or a light source for generating the monitoring beam is arranged at that side lying opposite the sensor.

It also proves advantageous to wirelessly transmit the measured values acquired with the mobile measurement device [(11)] 11 to a stationary measured value receiver with a measured value transmitter [(16)] 16 integrated into the measurement device [(11)] 11. In the illustrated exemplary embodiment, the stationary measured value receiver [(17)] 17 is likewise attached to the drive tower [(9)] 9 of the engraving machine. The measured values wirelessly communicated to the measured value receiver [(17)] 17 are converted thereat into electrical measured value signals MS on a line [(18)] 18 for further-processing. The transmission of the measured values can [ensue] occur with light, for example IR light, sound or electromagnetically [(RF)] RF.

For assuring dependable operation, it proves advantageous to only enable the transmission of measured values to an engraving machine when a measurement device [(11)] 11 is also located on the printing cylinder [(1)] 1 of the [appertaining] corresponding engraving machine and the measured values are also in fact needed for calibration. In order to meet this demand, the [enable] enablement of the measured value transmission is inventively controlled by the control signal KS.

The measurement device [(11)] 11, which is configured for a wireless measured value transmission and -- over and above this -- is battery operated, can be advantageously utilized for a plurality of engraving machine, whereby each engraving machine is equipped with a monitoring device [(]12, 13, 14[)] and a measured value receiver [(17)] 17, and the mobile measurement device [(11)] 11 is transported from engraving machine to engraving machine as needed.

In this case, too, it proves expedient to control the measured value transmission to an engraving machine with the control signal KS of this engraving machine such that the measured value transmission [ensues] occurs only in the calibration phase and, selectively, only for the [appertaining] corresponding engraving machine.

Figure 2 shows a block circuit diagram of an engraving machine. The printing cylinder [(1)] 1 is rotationally driven by the cylinder drive [(8)] 8. The engraving on the printing cylinder [(1) ensues] 1 occurs with an engraving element [(20)] 20 that, for example, is [fashioned] designed as an electromagnetic engraving element with an engraving stylus [(21)] 21 as the cutting tool. The engraving element [(20)] 20 is located on an engraving carriage [(22)] 22 that is moved axially past the printing cylinder [(1)] 1 by an engraving carriage drive [(24)] 24 by means of a spindle [(23)] 23.

The engraving stylus [(22)] 22 of the engraving element [(21)] 21 is controlled by an engraving control signal GS. The engraving control signal GS is formed in an engraving amplifier [(25)] 25 by superimposition of a periodic raster signal R with image signal values B that represent the tonal values between "light" and "dark" of the cups to be engraved. Whereas the periodic raster signal R effects a vibrating lifting motion of the engraving stylus [(21)] 21 for generating the engraving raster, the image signal values B determine the penetration depth of the engraving stylus [(21)] 21 into the printing cylinder [(1)] 1 in conformity with the tonal values to be engraved.

The analog image signal values B are acquired in a D/A converter [(26)] 26 from engraving data GD that are deposited in an engraving data memory [(27) and] 27, are read out therefrom engraving line by engraving line, and are supplied to the D/A converter [(26)] 26.

The printing cylinder [(1)] 1 has an XY-coordinate system allocated to it whose X-axis is oriented in the axial direction of the printing cylinder [(1)] 1 and whose Y-axis is oriented in the circumferential direction of the printing cylinder [(1)]

1. The engraving carriage drive [(24)] 24 generates the x-location coordinates and a position sensor [(28)] 28 mechanically coupled to the cylinder drive [(8)] 8 generates the y-location coordinates, these being supplied via lines [(29, 30)] 29, 30 to a controller [(31)] 31.

The controller [(31)] 31 controls the addressing and the readout of the engraving data [(GD)] GD from the engraving data memory [(27)] 27 dependent on the xy-coordinates of the current engraving locations via a line [(32).] 32. The controller [(31)] 31 also generates the raster signal R on a line [(33)] 33, a control signal S_1 on a line [(34)] 34 for starting and stopping the cylinder drive [(8)] 8, and a control signal S_2 on a line [(35)] 35 for starting and stopping the engraving carriage drive [(24)] 24.

For the implementation of a test cut before the actual engraving, the engraving machine comprises a test engraving computer [(36)] 36 that supplies the engraving data [(GD*)] GD* required for engraving the sample cups [(10)] 10 to the D/A converter [(26)] 26, these representing the predetermined rated tonal value of the sample cup [(10)] 10. After the test engraving, the measurement device [(11)] 11 is put in place on the printing cylinder, as described in Figure 1. The geometrical actual dimensions of the engraved samples cups [(10)] 10 are then measured with the measurement device [(11)] 11 and transmitted to the measured value receiver [(17)] 17, the measured actual dimensions being transported from the latter to the test engraving computer [(36)] 36 as measured value signal MS via the line [(18)] 18. By comparing the measured actual dimensions to predetermined rated dimensions, setting values for the calibration of the engraving amplifier [(25)] 25 that are supplied thereto via a line [(37)] 37 are acquired in the test engraving computer [(36)] 36.

The control signal KS generated by the monitoring device [(]12, 13, 14[)], whereof only the optoelectronic sensor [(12)] 12 is shown in Figure 2, proceeds via the line [(15)] 15 to the controller [(31)] 31 If one forgot to remove the measurement device [(11)] 11 (not shown in Figure 2) from the printing cylinder [(1)] 1 after the calibration phase, the control signal KS in the controller [(31)] 31 -- via the control

signal S_1 -- prevents the rotation of the printing cylinder and, potentially, prevents the feed motion of the engraving carriage [(22)] 22 via the control signal S_2.

The control signal KS also controls an enable unit [(38)] 38 with which the transfer of the measured signals MS to the test engraving computer [(36)] 36 is enabled only in the calibration phase.

[Abstract] While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

[The invention relates to] ABSTRACT OF THE DISCLOSURE

In a method for operating an electronic engraving machine for engraving printing cylinders for rotogravure with an engraving stylus of an engraving element driven by an engraving control signal[. For], for calibration of the engraving control signal, sample cups [(10)] for prescribed rated tonal values are engraved in a test engraving and their actual dimensions are measured with a mobile measurement device [(11)] but in place on the printing cylinder[(1)]. In order to avoid a destruction of the measurement device[(11)], a monitoring device [(12, 13, 14)] monitors whether the measurement device [(11)] is on the printing cylinder [(1)] or not and prevents an engraving start when the measurement device [(11)] is present on the printing cylinder[(1)]. The identified measured values are wirelessly transmitted from the mobile measurement device [(11)] to a stationary measured value receiver[(17)]. The monitoring device [(12, 13, 14)] assures that the wireless transmission of the measured values only [ensues] occurs during the calibration.

[Figure 1]

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METHOD FOR THE OPERATION OF AN ENGRAVING MACHINE

The invention is in the field of electronic reproduction technology and is directed to a method for the operation of an electronic engraving machine for engraving printing cylinders for rotogravure, to an electronic engraving machine as well as to a measuring device for an engraving machine.

In an electronic engraving machine, an engraving element with an engraving stylus as cutting tool moves along a rotating printing cylinder in axial direction. The engraving stylus, which is controlled by an engraving control signal, cuts a series of cups arranged in an engraving raster into the generated surface of the printing cylinder. The engraving control signal is formed by superimposition of image signal values, which represents [sic] to tonal values between "light" and "dark" to be engraved, with a periodic raster signal. Whereas the raster signal effects a vibrating lifting motion of the engraving stylus for generating the engraving raster, the image signal values determine the geometrical dimensions of the cups engraved into the generated surface of the printing cylinder.

Before the actual engraving, sample cups are engraved on the printing cylinder for prescribed tonal values in what is referred to as a test engraving. After the test cut, the actual geometrical dimensions of the engraved sample cups are measured, for example with a measurement microscope placed onto the printing cylinder, and compared to prescribed, rated geometrical dimensions of the cups. Setting values are acquired from the value comparison, the engraving control signal being then calibrated such with said setting values that the cups actually engraved in the later engraving correspond to the cups required for a tonally correct reproduction.

When the operator must operate a plurality of engraving machines simultaneously, particularly in magazine printing, it can occasionally occur in practice that the operator forgets to remove a measurement microscope placed on the printing cylinder for measuring the sample cups from the printing cylinder before the engraving actually starts, as a result whereof the relatively expensive measurement microscope and, potentially, the engraving machine itself can be damaged.

An object of the present invention is therefore to improve a method for the operation of an engraving machine, an engraving machine as well as a measurement device for an engraving machine such that a reliable engraving is assured, especially given simultaneous operation of a plurality of engraving machines.

This object is achieved by claim 1 with respect to the method, by claim 10 with respect to the engraving machine and by claim 16 with respect to the measurement device. Advantageous developments and improvements are indicated in the subclaims.

The invention is explained in greater detail below on the basis of Figures 1 and 2.

Shown are:

Figure 1 the fundamental mechanical structure of an engraving machine, shown in a side view; and

Figure 2 a block circuit diagram of an engraving machine.

Figure 1 shows a side view of the fundamental mechanical structure of an electronic engraving machine for engraving printing cylinders for rotogravure. The engraving machine, for example, is a HelioKlischograph® of Hell Gravure Systems GmbH, Kiel, DE.

A printing cylinder (1) has its shaft ends (2, 3) rotationally seated in two pillow blocks (4, 5) that are mounted on a machine bed (6). Via a coupling (7), the printing cylinder (1) is driven by a cylinder drive (8) that is accommodated in a lateral drive tower (9) of the engraving machine. The engraving on the printing cylinder (1) ensues with an engraving stylus of an engraving element (not shown) that is driven by an engraving control signal and moves axially along the rotating printing cylinder (1) for planar engraving.

Before the actual engraving of the printing cylinder (1), sample cups (10) are engraved on the printing cylinder (1) in the test engraving, the actual geometrical dimensions of said sample cups (10) being measured with an optical or electronic measurement device (11) put in place on the printing cylinder (1) and being compared to the prescribed, rated geometrical dimensions of the sample cups (10). Setting values are acquired from the value comparison, the engraving control signal being

then calibrated such with said setting values that the cups actually engraved in the later engraving correspond to the cups required for a tonally correct reproduction. The measurement device (11), for example, is a measurement microscope with an integrated scale or a video camera. In the case of a video camera, the measurement of the actual dimensions of the engraved sample cups ensues electronically in the video image registered by the video camera, for example according to WO-A-98/55302.

When the operator, in particular, must operate a plurality of engraving machines simultaneously, it can occasionally occur in practice that the operator forgets to remove the measurement device (11) from the printing cylinder (1) before starting the engraving, and damage to the relatively expensive measurement device and/or to the engraving machine would be the consequence.

In order to avoid such damage, automatic supervision is inventively carried out as to whether a measurement device (11) is located on the printing cylinder (1) or not and, when this is the case, an engraving start is prevented and/or displayed.

To this end, the engraving machine comprises a monitoring device (12, 13, 14) that, given the illustrated exemplary embodiment, is composed of a stationary optoelectronic sensor (12) attached to the drive tower (9) of the engraving machine and a reflector (13) that is located at the measurement device (11) and faces toward the sensor (12). The sensor (12) generates a monitoring beam (14) proceeding in axial direction of the printing cylinder (1) that the reflector (13) of the measurement device (11) reflects onto the stationary sensor (12) when the measurement instrument (11) is situated on the printing cylinder (1). The sensor (12) then generates a corresponding electrical control signal KS on a line (15) for further processing.

The sensor (12) is attached to the drive tower (9) at such a height that the reflector (13) approximately lies on the optical axis of the sensor (12) when the measurement device (11) is on a printing cylinder (1) having an average diameter. Expediently, the monitoring beam (14) fashioned is lobar in propagation direction with a relatively large crossection in the region of the reflector (13). What is thereby achieved is that the monitoring beam (14) is also acquired by the reflector (13) when the latter is offset to different heights due to different diameters of the respective

printing cylinder (1) or in circumferential direction of the printing cylinder (1) due to an imprecise positioning of the measurement device (11) relative to the optical axis of the sensor (12). As a result of the lobe shape of the monitoring beam (14), the reflection is also independent of the axial measuring position of the measurement device (11) on the printing cylinder (1). Further, it proves expedient to attache a corresponding reflector (13) to each end face of the measurement device (11). The invention is not limited to the described exemplary embodiment for the monitoring device. For example, the monitoring of the measurement device can also ensue with a light barrier. In this case, the reflector is stationarily secured to the engraving machine or a light source for generating the monitoring beam is arranged at that side lying opposite the sensor.

It also proves advantageous to wirelessly transmit the measured values acquired with the mobile measurement device (11) to a stationary measured value receiver with a measured value transmitter (16) integrated into the measurement device (11). In the illustrated exemplary embodiment, the stationary measured value receiver (17) is likewise attached to the drive tower (9) of the engraving machine. The measured values wirelessly communicated to the measured value receiver (17) are converted thereat into electrical measured value signals MS on a line (18) for further-processing. The transmission of the measured values can ensue with light, for example IR light, sound or electromagnetically (RF).

For assuring dependable operation, it proves advantageous to only enable the transmission of measured values to an engraving machine when a measurement device (11) is also located on the printing cylinder (1) of the appertaining engraving machine and the measured values are also in fact needed for calibration. In order to meet this demand, the enable of the measured value transmission is inventively controlled by the control signal KS.

The measurement device (11), which is configured for a wireless measured value transmission and -- over and above this -- is battery operated, can be advantageously utilized for a plurality of engraving machine, whereby each engraving machine is equipped with a monitoring device (12, 13, 14) and a measured value

receiver (17), and the mobile measurement device (11) is transported from engraving machine to engraving machine as needed.

In this case, too, it proves expedient to control the measured value transmission to an engraving machine with the control signal KS of this engraving machine such that the measured value transmission ensues only in the calibration phase and, selectively, only for the appertaining engraving machine.

Figure 2 shows a block circuit diagram of an engraving machine. The printing cylinder (1) is rotationally driven by the cylinder drive (8). The engraving on the printing cylinder (1) ensues with an engraving element (20) that, for example, is fashioned as an electromagnetic engraving element with an engraving stylus (21) as cutting tool. The engraving element (20) is located on an engraving carriage (22) that is moved axially past the printing cylinder (1) by an engraving carriage drive (24) by means of a spindle (23).

The engraving stylus (22) of the engraving element (21) is controlled by an engraving control signal GS. The engraving control signal GS is formed in an engraving amplifier (25) by superimposition of a periodic raster signal R with image signal values B that represent the tonal values between "light" and "dark" of the cups to be engraved. Whereas the periodic raster signal R effects a vibrating lifting motion of the engraving stylus (21) for generating the engraving raster, the image signal values B determine the penetration depth of the engraving stylus (21) into the printing cylinder (1) in conformity with the tonal values to be engraved.

The analog image signal values B are acquired in a D/A converter (26) from engraving data GD that are deposited in an engraving data memory (27) and read out therefrom engraving line by engraving line and supplied to the D/A converter (26).

The printing cylinder (1) has an XY-coordinate system allocated to it whose X-axis is oriented in axial direction of the printing cylinder (1) and whose Y-axis is oriented in circumferential direction of the printing cylinder (1). The engraving carriage drive (24) generates the x-location coordinates and a position sensor (28) mechanically coupled to the cylinder drive (8) generates the y-location coordinates, these being supplied via lines (29, 30) to a controller (31).

The controller (31) controls the addressing and the readout of the engraving data (GD) from the engraving data memory (27) dependent on the xy-coordinates of the current engraving locations via a line (32). The controller (31) also generates the raster signal R on a line (33), a control signal S_1 on a line (34) for starting and stopping the cylinder drive (8) and a control signal S_2 on a line (35) for starting and stopping the engraving carriage drive (24).

For the implementation of a test cut before the actual engraving, the engraving machine comprises a test engraving computer (36) that supplies the engraving data (GD*) required for engraving the sample cups (10) to the D/A converter (26), these representing the predetermined rated tonal value of the sample cup (10). After the test engraving, the measurement device (11) is put in place on the printing cylinder, as described in Figure 1. The geometrical actual dimensions of the engraved samples cups (10) are then measured with the measurement device (11) and transmitted to the measured value receiver (17), the measured actual dimensions being transported from the latter to the test engraving computer (36) as measured value signal MS via the line (18). By comparing the measured actual dimensions to predetermined rated dimensions, setting values for the calibration of the engraving amplifier (25) that are supplied thereto via a line (37) are acquired in the test engraving computer (36).

The control signal KS generated by the monitoring device (12, 13, 14), whereof only the optoelectronic sensor (12) is shown in Figure 2, proceeds via the line (15) to the controller (31) If one forgot to remove the measurement device (11) (not shown in Figure 2) from the printing cylinder (1) after the calibration phase, the control signal KS in the controller (31) -- via the control signal S_1 -- prevents the rotation of the printing cylinder and, potentially, prevents the feed motion of the engraving carriage (22) via the control signal S_2.

The control signal KS also controls an enable unit (38) with which the transfer of the measured signals MS to the test engraving computer (36) is enabled only in the calibration phase.

Patent Claims

1. Method for operating an electronic engraving machine for engraving printing cylinders for rotogravure, whereby

-- an engraving stylus (21) of an engraving element (20) drive by an engraving control signal (GS) engraves a sequence of cups into the rotating printing cylinder (1) whose actual dimensions determined the actual tonal values that are engraved,

-- sample cups (10) for predetermined sated tonal values are engraved in a test engraving occurring before the actual engraving of the printing cylinder (1), and

-- the actual dimensions of the samples cups (10) are measured with a measurement device (11) put in place on the printing cylinder and are compared to the rated dimensions that determine the prescribed rated tonal values in order to acquire setting values with which the engraving control signal (GS) is calibrated such that the engraved actual tonal values correspond to the rated tonal values to be engraved,

characterized in that

-- monitoring is carried out to see whether the measurement device (11) is located on the printing cylinder (1) or not; and

-- an engraving start is prevented when the measurement device (11) is present on the printing cylinder (1).

2. Method for operating an engraving machine according to claim 1, characterized in that the rotation of the printing cylinder (1) is prevented given the presence of the measurement device (11) on the printing cylinder (1).

3. Method for operating an engraving machine according to claim 1 or 2, characterized in that the presence of the measurement device (11) is monitored with a light beam.

4. Method for operating an engraving machine according to at least one of the claims 1 through 3, characterized in that a control signal (KS) is generated given the presence of the measurement device (11) on the printing cylinder (1).

5. Method for operating an engraving machine according to at least one of the claims 1 through 4, characterized in that the actual dimensions of the engraved sample cups (10) measured with the measurement device (11) are wirelessly transmitted from the mobile measurement device (11) to a stationary measured value receiver (17) as measured value signals (MS).

6. Method for operating an engraving machine according to claim 5, characterized in that the stationary measured value receiver (17) is located at the engraving machine.

7. Method for operating an engraving machine according to claim 5 or 6, characterized in that the wireless transmission of the measured values signals (MS) only ensues during the calibration.

8. Method for operating an engraving machine according to at least one of the claims 1 through 7, characterized in that the wireless transmission of the measured value signals (MS) is enabled by the control signal (KS).

9. Method for operating an engraving machine according to at least one of the claims 1 through 8, characterized in that

-- a plurality of engraving machine are present;
-- the measurement device (11) is respectively put in place on the printing cylinder (1) of that engraving machine with which the test engraving was implemented; and
-- the wireless transmission of the measured value signals (MS) is respectively selectively enabled by the control signal (KS) of the appertaining engraving machine.

10. Engraving machine for engraving printing cylinders (1) for rotogravure with an engraving element (20), composed of

-- a rotationally seated printing cylinder (1) that is drive by a first drive (8),
-- an engraving element (20) charged by an engraving control signal (GS) for engraving cups in the printing cylinder (1) that can be moved axially past the printing cylinder (1) by a second drive,
-- a signal editing unit (25, 26, 27, 35) for generating the engraving control signal (GS) for the engraving element (20), and

-- a controller (31) for controlling the engraving machine that is in communication with the signal editing unit (25, 26,27, 35), with the first drive (8) and with the second drive (23, 24),

characterized in that the engraving machine comprises a monitoring device (12, 13, 14) connected to the controller (31) that checks the presence of a measurement device (11) put in place on the printing cylinder (1) for measuring the actual dimensions of engraved sample cups (10) and prevents a start of engraving a warranted.

11. Engraving machine according to claim 10, characterized in that the monitoring device (12, 13, 14) is composed of the following components:

-- a stationary optoelectronic sensor (12) for generating a monitoring beam (14) proceeding in axial direction of the printing cylinder (1) and for converting the reflected monitoring beam (14) into an electrical control signal (KS) that signals the presence of the measurement device (11) on the printing cylinder (1), and

-- a reflector (13) for the monitoring beam (14) that is attached to the measurement device (11) and faces toward the stationary sensor (12).

12. Engraving machine according to claim 11, characterized in that the optoelectronic sensor (12) is attached to the engraving machine.

13. Engraving machine according to claim 11 or12, characterized in that the monitoring beam (14) is fashioned lobar in axial direction of the printing cylinder (1).

14. Engraving machine according to one of the claims 11 through 13, characterized in that

-- the measurement device (11) comprises a built-in measured value transmitter (16) for the wireless transmission of the measured actual dimensions of the test cups; and

-- a corresponding measured value receiver (17) that is connected to the signal editing unit (25, 26, 27, 36) is attached to the engraving machine.

15. Engraving machine according to one of the claims 11 through 14, characterized in that the monitoring device (12, 13, 14) is in an interactive connection with the measured value receiver (17).

16. Measurement device for an engraving machine for engraving printing cylinders (1) with an engraving element, characterized in that the measurement device (11) comprises a built-in measured value transmitter (16) for the wireless transmission of the measured actual dimensions of engraved test cups (10) to a stationary measured value receiver (17).

17. Measurement device according to claim 16, characterized in that the measurement device (11) is battery operated.

18. Measurement device according to claim 16, characterized in that the measurement device (11) is a measuring microscope.

19. Measurement device according to claim 16 or 17, characterized in that the measurement device (11) is a video camera.

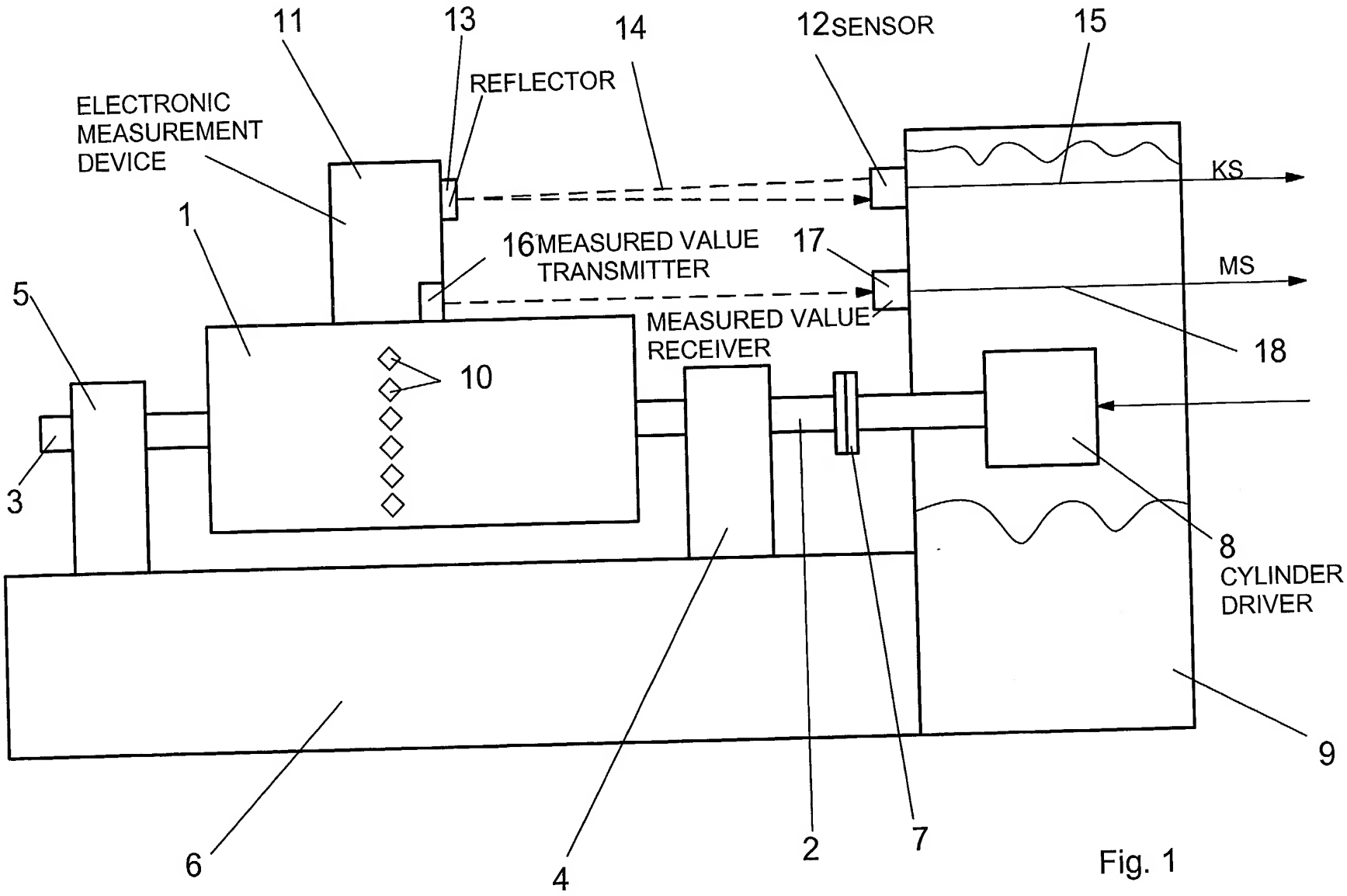

Fig. 1

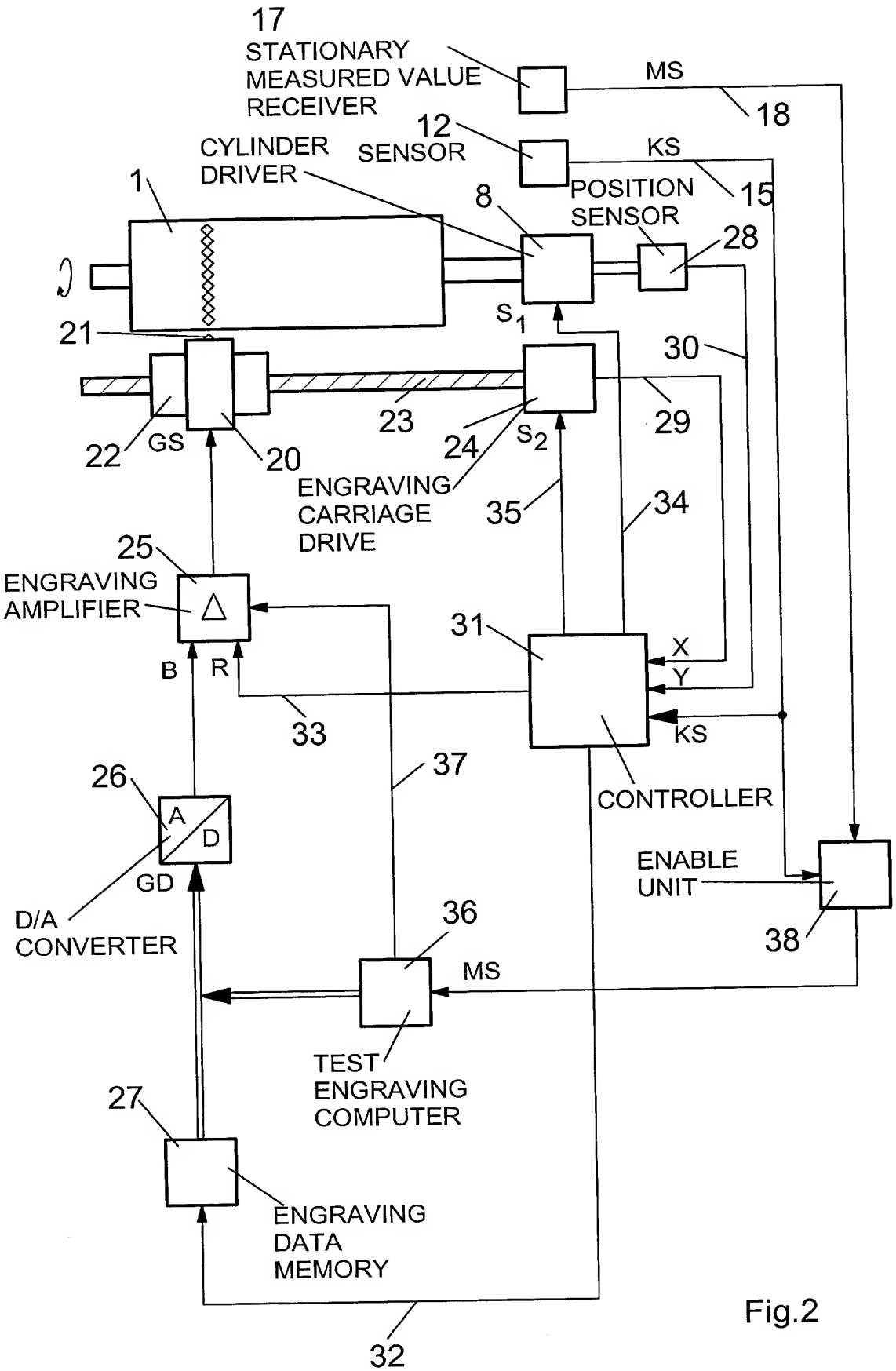
17
STATIONARY MEASURED VALUE RECEIVER
MS
18
12
SENSOR
KS
15
CYLINDER DRIVER
1
8
POSITION SENSOR
28
21
S_1
30
23
24
S_2
29
22
GS
20
ENGRAVING CARRIAGE DRIVE
35
34
25
ENGRAVING AMPLIFIER
31
X
Y
B
R
33
KS
CONTROLLER
37
26
A
D
GD
D/A CONVERTER
ENABLE UNIT
38
36
MS
TEST ENGRAVING COMPUTER
27
ENGRAVING DATA MEMORY
32

Fig.2

COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY
(Includes Reference to PCT International Applications) **PCT/DE00/01133**

ATTORNEY'S DOCKET NUMBER **P01,0315**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name, I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

"METHOD AND APPARATUS FOR THE OPERATION OF AN ENGRAVING MACHINE"

the specification of which (check only one item below):

☐ is attached hereto.

☐ was filed as United States application
Serial No. _____

on _____,

and was amended

on _____(if applicable).

☒ was filed as PCT international application

Number **PCT/DE00/01133**

on **12 April 2000**,

and was amended under PCT Article 19

on _____(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (if PCT indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
GERMANY	**199 20 207.9**	**03 May 1999**	■ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO
			☐ YES ☐ NO

Combined Declaration For Patent Application and Power of Attorney (Continued)
(Includes Reference to PCT International Applications) **PCT/DE00/01133**

ATTORNEY'S DOCKET NO. **P01,0315**

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject mater of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, Untied States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)			

POWER OF ATTORNEY: And I hereby appoint all Attorneys identified by United States Patent & Trademark Office customer number 26574, who are all members of the firm of Schiff Hardin and Waite.

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	POST OFFICE ADDRESS	POST OFFICE ADDRESS **Am Hang 16**	CITY **24113 Molfsee**	STATE & ZIP CODE/COUNTRY **GERMANY**
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	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
203	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
	RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203
DATE 10/24/01	DATE	DATE